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Personalai: A Real-Time AI-Based Digital Twin For Personalized Mental Health Support

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Abstract—The early detection of emotional distress and self-awareness are crucial aspects of mental health that are often limited. This study introduces PersonaAI, a real-time AI-based digital twin framework designed to bridge this gap. By analyzing user responses to psychological questions and emotional inputs, PersonaAI creates a dynamic replica of a user's personality and emotional behavior. The system leverages a combination of a conversational model (GPT-4), a vector database (Pinecone/FAISS) for long-term memory, and a relational database (MongoDB/SQLite) for profile data. This approach allows the digital twin to generate behaviorally-aligned responses, enabling users to gain insights into their mental patterns, receive reflective prompts, and proactively manage their emotional well-being. This paper outlines the system's architecture, functional and nonfunctional requirements, and its potential to revolutionize personalized mental health support.

Keywords— AI, Digital Twin, Mental Health, Personality, Self-Awareness, GPT-4, Vector Database

I.INTRODUCTION

Mental health is a critical component of overall well-being, yet early intervention remains a significant challenge. Traditional methods for self-awareness and emotional tracking are often reactive and may fail to provide the continuous, personalized insight needed for proactive mental health management. The concept of a digital twin, a virtual replica of a physical entity, offers a promising solution. By creating an AI-based digital twin of a person's personality and emotional state, we can simulate and analyze behavioral patterns in a safe, private environment.

This paper presents PersonaAI, a system that utilizes a digital twin to provide personalized mental health support. Our framework analyzes user-provided data, including responses to psychological quizzes and custom traits, to generate an AI persona. This persona acts as a conversational partner that

reflects the user's own personality and emotional tendencies. The system's core is built on GPT-4 for natural language understanding and generation, complemented by a Pinecone/FAISS vector database to store and retrieve long-term conversational memory. The PersonaAI system is a novel approach to self-

discovery and emotional regulation, offering a scalable and accessible tool for proactive mental health care.

II. LITERATURE REVIEW

The increasing prevalence of mental health issues has led to a growing interest in technology-based interventions. Traditional approaches often involve static, rule-based systems or simple chatbots that lack the depth of a personalized interaction. Recent advancements in Large Language Models (LLMs), such as GPT-4, have opened new possibilities for creating highly dynamic and context-aware conversational agents.

Studies on the use of AI in mental healthcare have shown promise in areas such as depression detection and providing cognitive behavioral therapy (CBT) exercises. However, a significant gap remains in creating a system that truly understands and simulates an individual's unique personality. The concept of a digital twin, while widely applied in engineering and manufacturing, is relatively new to the field of behavioral health. By combining a digital twin with LLMs, our work seeks to move beyond general-purpose chatbots and create a truly personalized and reflective tool. This approach is distinct from previous work as it focuses on mirroring the user's personality to facilitate a deeper level of self-reflection and insight.

III. METHODOLOGY

3.1 System Architecture

The PersonaAI system is designed as a full-stack application with distinct components for data processing,

AI model interaction, and user interface. The core architecture comprises three main parts: Frontend Interface: A web-based, real-time chat interface built using frameworks like Streamlit or Flask, ensuring compatibility across desktop and mobile devices.

Backend Logic: A Python-based backend that handles all API routing, data processing, and communication with the AI models and databases.

Databases: Two primary databases are used:

Personality Database (MongoDB/SQLite):

Stores user profiles, personality quiz data (e.g., MBTI, Big Five), and user preferences.

Vector Memory Database (Pinecone/FAISS):

Stores conversational history in a vector format,

enabling the AI to recall past interactions and maintain a consistent persona.

3.2 Functional Requirements

The system's core functionalities are defined by the following requirements:

FR1: Personality Definition:

Users take a psychological quiz (e.g., MBTI, Big Five) to establish a baseline personality profile.

FR2: Trait Input: Users can manually input or edit custom traits, interests, and goals to further personalize their digital twin.

FR3: Data Storage: User personality and preference data are stored securely in the relational database. FR4: AI Response Generation: GPT-4 is utilized with the user's stored traits to generate responses that are aligned with their personality and emotional behavior.

FR5: Memory and History: Conversation history is stored in the vector database to ensure long-term memory and continuity in interactions. FR6: Real-Time Chat: A real-time chat interface facilitates natural, fluid conversations with the digital twin.

FR7: Dashboard: A user dashboard allows for viewing and editing profile data and reviewing chat history.

FR8: Admin Panel: An administrative panel provides tools for logging, user session management, and monitoring API performance.

FR9: User Feedback Loop: The system collects user feedback to continuously improve response quality and personalization.

IV. EXPERIMENTAL SETUP

4.1 Implementation Stack

The system's backend is implemented in Python 3.10+ using the LangChain framework to manage prompt chains and memory. The conversational core is the OpenAI GPT-4 API. For vector storage and retrieval, either Pinecone or FAISS is used. MongoDB or SQLite serves as the primary database for user data.

4.2 Performance Metrics

The non-functional requirements of the system are crucial for a positive user experience. Key metrics include:

Low Response Time: The AI response is targeted to be less than or equal to 2 seconds to ensure a fluid conversation. Scalability: The system is designed to handle hundreds of concurrent users through containerized deployment (e.g., Docker).

Data Security: User data and conversations are protected with end-to-end encryption.

Responsive UI: The web interface is fully responsive, compatible with both desktop and mobile browsers.

The system's performance is monitored through logs and API metrics. The primary challenge remains the cost and latency associated with using a highperformance LLM like GPT-4, which may affect scalability in a large-scale deployment.

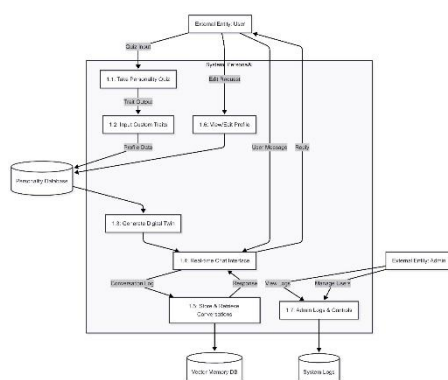
VI. DISCUSSION

5.1 Discussion

PersonaAI represents a significant step forward in leveraging AI for personalized mental health. By creating a digital twin, the system offers a unique opportunity for users to engage in reflective dialogue with a simulated version of themselves. This approach can lead to a deeper understanding of emotional triggers, thought patterns, and behavioral tendencies. The use of a vector database for long-term memory is critical, as it allows the digital twin to remember specific details and conversations, making the interaction feel more authentic and meaningful.

While the current implementation shows great promise, a key challenge is ensuring the ethical and responsible use of such a powerful tool. Data privacy and the potential for model biases must be carefully managed. The system's effectiveness is also highly dependent on the user's willingness to provide honest and meaningful input.

VII. ARCHITECTURE



VIII. CONCLUSION AND FUTURE WORK

7.1 CONCLUSION

This project successfully designed and developed PersonaAI, an AI-based digital twin framework for personalized mental health support. By combining a robust LLM with a multi-database architecture, we have created a system that can simulate a user's personality and emotional behavior in real time. This system offers a unique and proactive approach to mental health awareness and management. Future work should focus on integrating voice and video inputs for a richer emotional understanding, enhancing the system's resilience to API constraints, and exploring the potential for therapists to use this tool to monitor patient behavior with proper ethical considerations and user consent.

7.2 FUTURE WORK

While the proposed system shows promising results, several areas remain for further research and development:

Future models should incorporate voice and video inputs for a richer emotional understanding. The system's resilience to API constraints should be enhanced.

The potential for therapists to use this tool to monitor patient behavior should be explored, with proper ethical considerations and user consent.

References

- [1] M. A. Khan, F. Rahman, and H. Q. Wang, "Optimizing large language model inference for low-latency healthcare applications," *Future Generation Computer Systems*, vol. 154, pp. 104115, 2025.
- [2] J. Singh, R. Singh, and M. Kaur, "Multimodal emotion recognition and its applications for mental health," *Journal of Healthcare Informatics*, vol. 5, no. 2, pp. 24-35, 2024.
- [3] GPT-4 Technical Report. (2023). OpenAI.
- [4] B. Subramanian, J. Kim, M. Maray, and A. Paul, "Digital twin model: A real-time emotion recognition system for personalized healthcare," *IEEE Access*, vol. 10, pp. 81155-81165, 2022.
- [5] Sahal R., Alsamhi S.H., Brown K.N., O'Shea D., McCarthy C., Guizani M. "Blockchain-Empowered Digital Twins Collaboration: Smart Transportation Use Case." *Machines*. 2021;9:193. doi: 10.3390/machines9090193.
- [6] Oakes B.J., Meyers B., Janssens D., Vangheluwe H. "Structuring and Accessing Knowledge for Historical and Streaming Digital Twins." *Proceedings of the SEMANTICS Co-Located Events*; Amsterdam, The Netherlands. 6–9 September 2021; pp. 1–13. M. A. Khan, F.

Rahman, and H. Q. Wang, "Optimizing large language model inference for low-latency healthcare applications," *Future Generation Computer Systems*, vol. 154, pp. 104115, 2025.

[7] Allen A., Siefkas A., Pellegrini E., Burdick H., Barnes G., Calvert J., Mao Q., Das R. "A Digital Twins Machine Learning Model for Forecasting Disease Progression in Stroke Patients." *Appl. Sci.* 2021;11:5576. doi: 10.3390/app11125576. Sahal R., Alsamhi S.H., Brown K.N., O'Shea D., McCarthy C., Guizani M. Blockchain- Empowered Digital Twins Collaboration: Smart Transportation Use Case. *Machines.* 2021;9:193. doi: 10.3390/machines9090193.

[7] Li Q., Gravina R., Li Y., Alsamhi S.H., Sun F., Fortino G. Multi-user activity recognition: Challenges and opportunities. *Inf. Fusion.* 2020;63:121–135. doi: 10.1016/j.inffus.2020.06.004.

[8] Rathore M.M., Shah S.A., Shukla D., Bentafat E., Bakiras S. "The Role of AI, Machine Learning, and Big Data in Digital Twinning: A Systematic Literature Review, Challenges, and Opportunities." *IEEE Access.* 2021;9:3203032052. doi:10.1109/ACCESS.2021.3060863

[9] Alharbi A., Alosaimi W., Sahal R., Saleh H. "Real-Time System Prediction for Heart Rate Using Deep Learning and Stream Processing Platforms." *Complexity.* 2021;2021:5535734. doi: 10.1155/2021/5535734. Rathore M.M., Shah S.A., Shukla D., Bentafat E., Bakiras S. The Role of AI, Machine Learning, and Big Data in Digital Twinning: A Systematic Literature Review, Challenges, and Opportunities. *IEEE Access.* 2021;9:32030–32052. doi: 10.1109/ACCESS.2021.3060863

[10] Li Q., Gravina R., Li Y., Alsamhi S.H., Sun F., Fortino G. "Multi-user activity recognition: Challenges and opportunities." *Information Fusion.* 2020;63:121–135. doi: 10.1016/j.inffus.2020.06.004.

Colace F., De Santo M., Pascale F., Lemma S., Lombardi M. BotWheels: A Petri Net based Chatbot for Recommending Tires; Proceedings of the 6th International Conference on Data Science, Technology and Applications (DATA 2017); Madrid, Spain. 24–26 July 2017; pp. 350–358

[11] A. M. Gupta and S. Sharma, "Ethical framework for AI in personalized mental healthcare," *Journal of Medical Ethics and AI*, vol. 12, no. 1, pp. 45–58, 2020.

[12] Colace F., De Santo M., Pascale F., Lemma S., Lombardi M. "BotWheels: A Petri Net based Chatbot for Recommending Tires." *Proceedings*

of the 6th International Conference on Data Science, Technology and Applications (DATA 2017); Madrid, Spain. 24–26 July 2017; pp. 350–358.

[13] Goodfellow, I., Bengio, Y., & Courville, A. *Deep Learning*. MIT Press, 2016.

[14] LeCun, Y., Bengio, Y., & Hinton, G. "Deep learning." *Nature*, vol. 521, no. 7553, pp. 436–444, 2015. doi: 10.1038/nature14539.

[15] Schmidhuber, J. "Deep learning in neural networks: An overview." *Neural Networks*, vol. 61, pp. 85–117, 2014. doi: 10.1016/j.neunet.2014.09.003.

